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SKIMMER AND FILTER

CROSS-REFERENCE TO RELATED APPLICATIONS

5 This application is related to U.S. Provisional Patent Application Serial No. 60/436,758 entitled, "Method and Apparatus for Pond Skimmer and Filter," filed on December 27, 2002, and claims the benefit of the filing date thereof. The entire specification of the priority application is incorporated herein by reference.

BACKGROUND

10 Technical Field:

The present invention relates generally to the field of water treatment devices for the removal of debris from bodies of water, in particular, the invention relates to the field of filters, skimmers, and water treatment devices for ornamental bodies of water, such as pools, ponds, waterfalls and streams.

15 Background:

Skimmers and filters are often used in conjunction to clean and treat decorative bodies of water for landscaping, such as ponds and waterfalls. In general skimmers skim debris from the surface of the water and filters remove smaller debris from the entire depth of the water. Skimmers typically filter larger debris from the water surface with a coarse net or basket, while filters incorporate filter media, which can
20 be a variety of materials including but not limited to mats, rocks, and nylon mesh, all of which have limited capacity for water treatment. Often one or more pumps are used to draw the water to the mouth of the skimmer or filter. Once the water has been skimmed or filtered, it is returned from the skimmer or filter to the body of water.

Skimmers and filters are usually installed external to the body of water but in proximity to it. For
25 example, many skimmers and filters are installed in the ground adjacent the body of water. These devices are cumbersome and require careful installation to eliminate or reduce water loss during the transfer of water between the body of water and the water treatment device. Another difficulty with

filters, skimmers, and water treatment devices generally, is that the mouth, or weir, size is fixed, requiring the user to select a skimmer or filter of a particular size for a given application. Yet another difficulty with skimmers and filters is their inadequacy in reducing or eliminating living organisms, such as single-celled algae, protozoa, and bacteria.

5 An improved skimmer and filter device is needed that could be easily and efficiently installed, and provide superior water treatment.

SUMMARY

10 The skimmer and filter unit of the present invention is for use with a body of water. A tank portion of the unit defines an interior having a skimmer chamber, ultraviolet light chamber, filter chamber, and pump chamber. In addition to skimming and filtration, water received into the unit is subjected to ultraviolet light within the ultraviolet light chamber.

15 Objects, advantages and novel features, and further scope of applicability of the skimmer and filter will be set forth in part in the detailed description to follow, taken in conjunction with the accompanying drawings, and in part will become apparent to those skilled in the art upon examination of the following, or may be learned by practice. The objects and advantages of the skimmer and filter may be realized and attained by means of the instrumentalities and combinations particularly pointed out in the appended claims.

20 BRIEF DESCRIPTION OF THE DRAWINGS

 The accompanying drawings, which are incorporated into and form a part of the specification, illustrate an embodiment of the skimmer and filter and, together with the description, serve to explain the principles of the skimmer and filter apparatus and method of operation. The drawings are not to be construed as limiting the skimmer and filter.

25 Fig. 1 is a perspective, cutaway, exploded view of the skimmer and filter with a centrally located pump chamber removed, two ultraviolet light chambers and a single filter cartridge in the filter chamber;

Fig. 2 is a perspective, cutaway view of the skimmer and filter of Fig. 1 showing the partitioning walls;

Fig. 3 is a perspective, cutaway view of the skimmer and filter showing application of a single centrally located ultraviolet light chamber, two filter cartridges and a rear pump chamber;

5 Fig. 4 is a perspective, cutaway view of the skimmer and filter of Fig. 3 showing the weir door and a weir divider from the interior;

Fig. 5 is a top interior view of the skimmer and filter of Figs. 3 and 4 with the neck portion removed;

Fig. 6 is a perspective view of the skimmer basket of the skimmer chamber;

10 Fig. 7 is a perspective view of the skimmer and filter tank and a plurality of interchangeable weir faceplates;

Fig. 8 is a perspective, exploded view of the tank, lid, weir dividers, weir door, and weir faceplate of the skimmer and filter;

Fig. 9 is a rear perspective view of the weir faceplate;

15 Fig. 10a is a perspective exploded view of an ultraviolet light assembly and associated mount;

Fig. 10b is a perspective exploded view of the ultraviolet light assembly and associated mount of Fig. 10a as assembled into the skimmer and filter unit;

Fig. 11 is a perspective exploded view of filtration media for the filter chamber of the skimmer and filter;

20 Fig. 12a is a perspective view of the flow bypass valve in the closed position;

Fig. 12b is a perspective view of the flow bypass valve in the open position;

Fig. 13a is a perspective view of the interlocking lid of the skimmer and filter;

Fig. 13b is a perspective view of the tank and interlocking lid of the skimmer and filter;

Fig. 14 is a perspective view of a landscape application for the skimmer and filter;

25 Fig. 15a is a top view of the landscape application for skimmer and filter unit of Fig. 14;

Fig. 15b is a side view of Fig. 15a; and

Fig. 16 is a side view of a mid-water intake feature of the skimmer and filter.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The skimmer and filter unit of the present invention is depicted with two configurations of the various chambers; however, it will be understood by those of skill in the art that these and other configurations of the skimmer and filter chambers are possible via the inventive principles.

Referring to Fig. 1, a perspective, cutaway, exploded view of skimmer and filter unit **10** is shown. Unit **10** includes a generally upright cylindrical tank portion **20** and interlocking lid **36**. Unit **10** is in fluid communication with a body of water via a mechanically sealed skimmer faceplate assembly **12** and elongated neck **14**. Neck **14** extends outward from a wall of tank portion **20**, the distal end of which is skimmer faceplate assembly **12**. Skimmer faceplate assembly **12** provides a watertight connection to concrete, flexible membrane, or clay-lined bodies of water. Weir opening **17** defined in weir faceplate **16** receives water from a body of water. Neck **14** accommodates a plurality of interchangeable weir faceplates **16**, each of which define an opening **17** of a different size. The selection of a weir faceplate **16** allows for the adjustment of the effective neck width, or weir width, to compensate for variable water flow rates. Weir faceplate **16** is sealed to neck **14** with a series of fastening means **19**, such as but not limited to screws, or nuts and bolts. Weir dividers **23** slide into mating slots of neck **14** to form the appropriate-sized fluid conduit that coincides with the dimensions of opening **17** of weir faceplate **16**.

Within unit **10** are skimmer chamber **24**, filtration chamber **28**, one or more ultraviolet (UV) light chambers **26**, and pump chamber **30**, defined by the interior of tank portion **20**, for the removal of debris, various suspended and dissolved organic wastes, and living organisms, such as single-celled algae, protozoa, and bacteria. Tank portion **20** contains removable, semi-rigid skimmer basket **25** within skimmer chamber **24** to collect floating debris from the water after the water has passed through and over a pivoting and buoyant weir door **18** (see also Fig. 4). One or more UV light chambers **26** are positioned downstream of skimmer chamber **24**.

Water flow, indicated with arrows, enters tank **20** through opening **17** over weir door **18**, downward through skimmer chamber **24**, then through one or more unidirectional ports located at the lower periphery of tank **20** through partitioning wall **31** to UV light chambers **26**, which subject the water

to high-intensity UV light for purification and eradication of contaminants such as single-celled algae. After passing through UV light chambers **26**, the water continues through ports to filter chamber **28** for the mechanical removal of suspended solids and biological treatment for the removal of dissolved organic compounds. Filter chamber **28** can perform this function with one or more cartridge-based bio-mechanical filter mats, or other suitable filtration means. After being drawn through filter chamber **28**, centrally located pump chamber **30** (pump not shown) pumps the water away from unit **10** back to the body of water.

Turning to Fig. 2, a perspective, cutaway view of skimmer and filter unit **10** of Fig. 1 reveals the partitioning walls between the chambers. Partitioning walls **32** separate UV light chambers **26** and filter chamber **28**. Partitioning wall **31** separates skimmer chamber **24** from pump chamber **30**, filter chamber **28**, and UV chambers **26**.

Referring to Fig. 3, a perspective, cutaway view of skimmer and filter unit **10** shows application of a single central UV chamber **26**, two filter cartridges **29, 29'** and a rear pump chamber **30** (pump not shown). Pump chamber **30** houses submersible water pumps of various sizes and accommodates fittings for attachment to an external pumping apparatus or drain fitting. Pump chamber **30** is vertically-accessible for efficient removal of the pumping apparatus without disturbance of the bio-mechanical filter media of filter chamber **28** or other filtration components. Fig. 4 is a perspective, cutaway view of skimmer and filter unit **10** of Fig. 3 showing weir door **18** and a weir divider **23** from the interior.

Fig. 5 provides a top view of skimmer and filter unit **10** of Figs. 3 and 4 with neck **14** removed. Water enters over the weir door and travels downward through skimmer basket of skimmer chamber **24**. After passing through the skimmer basket, the water travels through unidirectional ports **13, 13'**, located in a lower portion of wall **31** near the bottom of tank **20**, into central UV chamber **26**. Water then travels from UV chamber **26** out of unidirectional ports **15, 15'** to filter chamber **28** where it passes through filter cartridges **29, 29'**. After passing through filter cartridges **29, 29'** the water is pulled into pump chamber **30** where it is expelled back to the body of water by the pumping apparatus.

Turning to Fig. 6, a perspective view of skimmer basket **25** of skimmer chamber **24** is shown. Skimmer basket **25** is removable by way of reaching into the interior of tank **20** and grasping handle **27**

affixed to basket **25** by an extended planar panel that places handle **27** conveniently within reach after removal of lid **36**. (See also Fig. 2.) In this manner, skimmer basket **25** is readily removed, cleaned, and/or replaced from tank **20** as needed.

Referring to Fig. 7, a perspective view of tank **20** of skimmer and filter unit **10** and a plurality of interchangeable weir faceplates **16** is shown. Each weir faceplate **16** defines an opening **17** of different dimensions to accommodate water flow. A pair of weir dividers **23** are used in conjunction with a particular weir faceplate **16** to guide water through neck **14** into skimmer chamber **24**. (See also Fig. 8.) Weir dividers **23**, **23'**, and **23''** are shown positioned vertically in the appropriate mating slots of neck **14** behind skimmer faceplate assembly **12** to align with the width of openings **17**, **17'**, and **17''** respectively of weir faceplates **16**, **16'**, and **16''**. For example, weir faceplate **16''** defining opening **17''** would require weir divider **23''** and its opposite weir divider (not shown) to be positioned in the innermost mating slots of neck **14** to align with the width dimension of opening **17''**.

Fig. 8 is a perspective, exploded view of tank **20**, interlocking lid **36**, weir dividers **23**, weir door **18**, and weir faceplate **16**. Weir dividers **23** are frictionally fit into mating slots **35** of neck **14**. Weir door **18** is frictionally fit into notches in lower corners of weir dividers **23** via mating hinge tabs at the lower corners of weir door **18**, such that weir door **18** pivots in response to water pressure. Weir faceplate **16** is secured to neck **14** with fastening means **19** through mating openings **21** (see Fig. 9) in weir faceplate **16** and neck **14**. In the event that the body of water is lined with a flexible membrane, or liner, the liner can be positioned between neck **14** and weir faceplate **16** and an incision made through the liner near the top of skimmer opening **17** to allow water to pass into the skimmer. Preferably, the water level entering weir faceplate **16** is within 0.75 inches above or below water level mark **52** of faceplate **16** for optimal operation.

Referring to Fig. 9, a rear perspective view of weir faceplate **16** is shown. Flexible locking tab **22** is used to secure weir door **18** in a closed position when cleaning or performing maintenance on skimmer and filter unit **10**. To lock weir door **18** in a closed position to prevent fluid communication between unit **10** and a body of water, weir door is rotated upward and the top of weir door **18** is secured

behind catch **33** of locking tab **22**. To release weir door, locking tab **22** is pressed upward and door **18** is released from its position behind catch **33**.

In addition to the skimming and filtering features of the skimmer and filter unit **10**, UV light is applied to the water for purification. Figs. 10a and 10b are perspective exploded views of a UV light assembly **37** as assembled into tank **20** of skimmer and filter unit **10**. UV mount **40** is affixed to the upper surface of UV chamber **26** defined within tank **20** with UV mount fastening means **39**, such as but not limited to screws, or nuts and bolts. UV light **41** that is affixed to locking ring **38** is positioned through UV mount **40** and into UV chamber **26** so that UV light **41** is fully inserted into UV chamber **26**. Tabs on locking ring **38** are inserted into mating slots in UV mount **40**. Once inserted, locking ring **38** is rotated approximately $\frac{1}{4}$ of a turn to secure UV light assembly **37** into UV light chamber **26**. A power source, such as one or more batteries, or electrical connection to a power outlet is used to power UV lights **41**.

Ultraviolet light purifies the water and eradicates contaminants. A baffle block can be used to prevent water flow to an unused UV chamber **26**. For example, water bodies less than approximately 5000 gallons may require operation of only one UV chamber for sufficient purification. Table 1 provides examples of UV lighting power and approximate gallons per hour (GPH) of water flow required through the UV light chamber for sufficient water treatment:

Table 1

Number of 25 Watt UV Lights	Number of 37 Watt UV Lights	GPH (min – max)
1	0	500 – 2500
0	1	500 – 4000
1	0	1200 – 2500
0	1	1200 – 4000
2	0	1200 – 5000
2	0	2500 – 5000
0	2	2500 – 8000

When beneficial bacteria is introduced to a body of water, power is preferably removed from the UV light for approximately 24 hours to allow the bacteria to settle.

Water is filtered within filter chamber **28** after the water has been treated with UV light in UV chambers **26**. Fig. 11 provides a perspective exploded view of filtration media for filter chamber **28**.

5 Filtering can be achieved, for example, with a bio-mechanical filter mat **42**, or other suitable filtration means, secured within a housing or cartridge **43** that is placed within filter chamber **28**.

After the water passes through filter chamber **28**, it enters pump chamber **30** where a pump pumps the water away from the skimmer and filter unit **10** back to the body of water. Occasionally, filter mats **42** become clogged with debris, which can prevent a sufficient flow of water to the pump. To
10 prevent this from occurring, float-actuated bypass valve **34** is integrated into partitioning wall **31** (see Fig. 3) between skimmer chamber **24** and pump chamber **30** to monitor the level of water within pump chamber **30** and allow additional water to flow into pump chamber **30** from skimmer chamber **24** should the water level be insufficient.

Referring in combination to Figs. 12a and 12b, perspective views of bypass valve **34** in the closed
15 and open positions are shown respectively. When the water level in pump chamber **30** is sufficiently high, valve **34** floats to the upper position and is stopped by stop **44'** affixed to partitioning wall **31**. At this point valve **34** blocks the flow of water through opening **45** defined in wall **31**. Should the water level in pump chamber **30** drop, valve **34** drops, until stopped by stop **44** affixed to partitioning wall **31**, and unblocks opening **45** defined in wall **31** thereby allowing the flow of water from skimmer chamber **24** into
20 pump chamber **30**.

Skimmer and filter unit **10** is protected from the environment by tank **20** and interlocking lid **36**. Turning to Figs. 13a and 13b, interlocking lid **36** and interlocking lid **36** affixed to tank **20** of skimmer and filter unit **10** are shown respectively. Lid **36** interlocks to tank **20** by stabilizing flange **48**, which extends around the periphery and orthogonally downward from the bottom planar surface of lid **36**, mirrors the
25 shape of, and mates with the interior upper surface of tank **20** (see also Fig. 8). Fastening means **46**, such as but not limited to screws or nuts and bolts, are positioned through mating openings **47** defined in lid **36** and tank **20** to secure lid **36** to tank **20**. Interlocking lid **36** having stabilizing flange **48** prevents

deformation of skimmer and filter unit **10** particularly when installed in subterranean environments. The exterior surface of lid **36** is coarse for increased frictional contact with external surroundings.

Turning to Fig. 14, a perspective view of a landscape application for skimmer and filter unit **10** is shown. If the landscape application includes waterfall, skimmer and filter unit **10** is positioned opposite
5 the waterfall at an end of a body of water for improved skimming and filtering operation. Preferably skimmer and filter unit **10** is positioned below ground level approximately six inches away from the coping shelf.

Fig. 15a provides a top view of the landscape application for skimmer and filter unit **10** and Fig. 15b provides a side view for the landscape application of Fig. 14. Preferably skimmer and filter unit **10** is
10 positioned so that the bottom surface of tank **20** is approximately nineteen inches below the intended water level and the bottom surface of neck **14** is approximately seven inches below the intended water level, leaving approximately three to five inches between the water level and the ground level surface created by backfilling around skimmer and filter unit **10**.

Referring to Fig. 16, a side view of an optional mid-water intake to skimmer and filter unit **10** is
15 shown. A mid-water intake aids in preventing wear on the pump if the water level falls below the level of the weir of skimmer faceplate assembly **12**. Further, in cold-weather applications when ice forms at the water surface, weir door **18** (see Fig. 8 and 9) can be closed via locking tab **22** and water can be drawn from beneath the surface of the ice through the mid-water intake directly into skimmer chamber **24**.

Although the skimmer and filter has been described in detail with reference to these
20 embodiments, other embodiments can achieve the same results. Variations and modifications of the skimmer and filter will be obvious to those skilled in the art and the appended claims are intended to cover all such modifications and equivalents.